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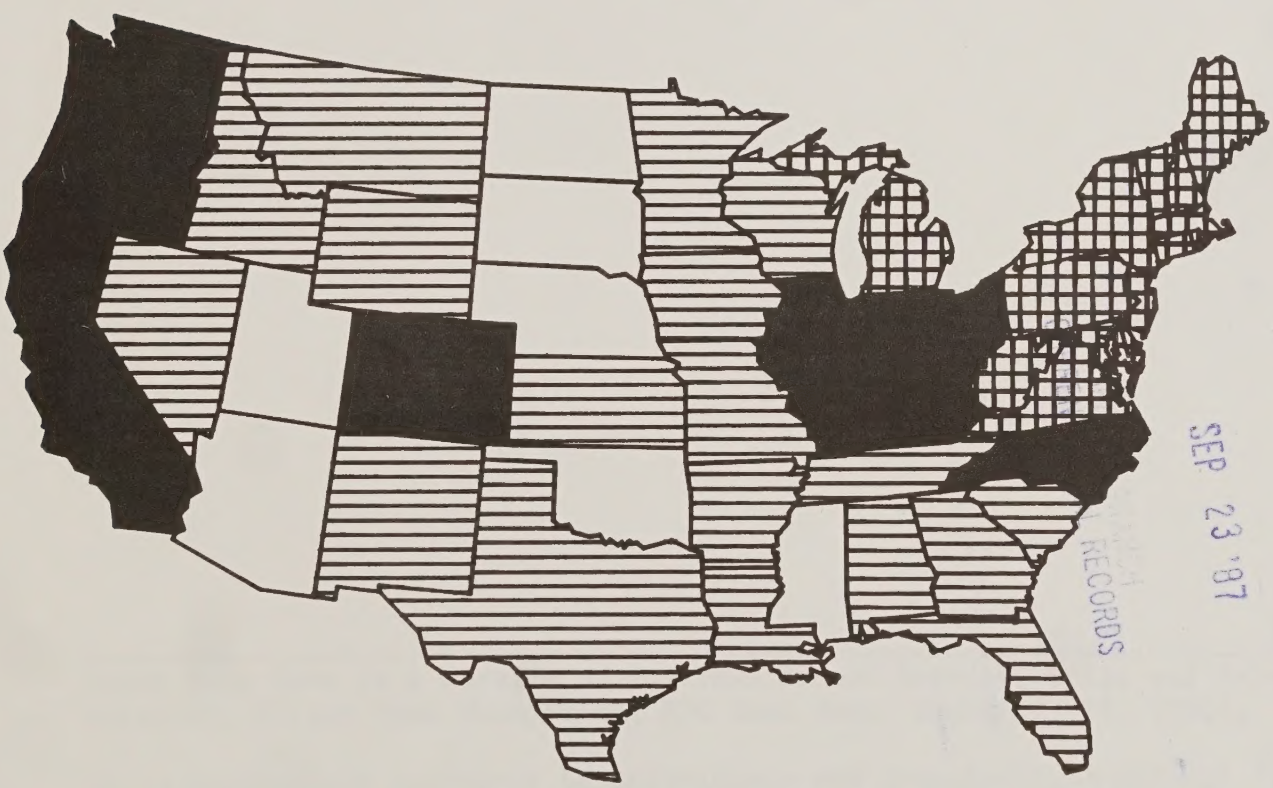
Number 14

GYPSY MOTH NEWS

370 REED ROAD, BROOMALL, PA 19008
U.S.D.A., FOREST SERVICE

GYPSY MOTH IN THE USA
1986



STATUS
- MOTHS TRAPPED
- SPOT INFESTED
- ESTABLISHED
- NOT PRESENT

Map prepared by
D. Twardus and H. Machesky,
USDA, Mr. 1987

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GYPSY MOTH SUPPRESSION PROJECTS - 1987 1/

STATE/SITE	BT	DIMILIN	SEVIN	TOTAL
State	----------Acres----------			
Delaware	16158	35452	0	51610
Maryland	33657	105924	0	139581
Michigan	34046	0	0	34046
New Jersey - AG	58549	0	0	58549
New Jersey - FOR	3639	0	0	3639
North Carolina 2/	3740	0	0	3740
Oregon 2/	12000	0	0	12000
Pennsylvania	114388	112343	0	226731
Virginia	6978	33648	0	40626
West Virginia	0	85000	0	85000
Subtotal	283155	372367	0	655522
Other Federal				
Allegheny NF, PA	29784	0	0	29784
Catoctin Mountain Park, MD	1300	0	0	1300
Camp David, MD	420	0	0	420
District of Columbia	2000	0	0	2000
Federal Emergency Management Agency, VA	0	350	0	350
Gettysburg National Military Park, PA	640	0	0	640
George Washington NF, VA	150	0	0	150
Harper's Ferry HP, WV	350	0	0	350
North Carolina NF 2/	495	4654	0	5149
Picatinny Arsenal, NJ	0	1222	0	1222
Raystown Lake, PA	0	1333	0	1333
Seneca Nation of Indians, NY	1166	0	3704	4870
Shenandoah Nat. Park, VA	3000	600	0	3600
West Point, NY	600	0	0	600
Subtotal	39905	8159	3704	51768
Grand Total	323060	380526	3704	707290

1/ Suppression projects are USDA Forest Service - State cooperative spray programs, unless otherwise footnoted.

2/ State/APHIS/FS cooperative project.

Summary of multiple applications:

State/Site	Actual Acres Sprayed	Total Acres Counting Multiple Applications
Oregon	12,000	36,000
District of Columbia	2,000	3,000
Michigan	34,046	54,073
Gettysburg Nat. Mil. Park	640	870
North Carolina Nat. Forest	5,149	10,298
North Carolina	3,740	7,258
Picatinny Arsenal	1,222	2,444

Grand total counting multiple applications is 762,446 acres.

FIRST YEAR MORTALITY FOLLOWING THE 1985 GYPSY MOTH DEFOLIATION IN WEST VIRGINIA

Jerry Atkins, Asst. State Forester
WV Dept. of Agriculture
Forestry Division
State Capitol
Charleston, WV 25305

The first gypsy moth defoliation in West Virginia occurred during the spring of 1985 and resulted in the defoliation of 3,004 acres of hardwood forests in Hampshire, Morgan and Berkeley Counties. An aerial survey was conducted and all areas with moderate to heavy defoliation (35% or greater loss of foliage) were delineated on 7 1/2 minute topographic maps.

In August 1986, the West Virginia Department of Agriculture personnel cruised 1,134 acres (38%) of the defoliated area to estimate the timber mortality caused by the gypsy moth in West Virginia. A systematic line plot cruise with each sample plot representing 7.2 acres was utilized to sample the defoliated area. A total of 157 samples were sampled at eight and one-half chain intervals (561 feet) on cruise lines eight and one-half chains apart at five different locations in Berkeley County.

Sample trees were selected with a 10 basal area factor prism and tallied by species, size class, and whether dead or alive. Trees which died prior to the gypsy moth defoliation as determined by Forestry Division Foresters were not tallied. Generally, oaks in the red oak group having extensive bark loss from the upper boles and tops and oaks in the white oak group having 25% or greater limb and twig breakage were judged to have died prior to the gypsy moth defoliation.

The total estimated timber damage in the 1,134 acre cruise area was $83,492 or $73.63 per acre. This total included 1.2 million board feet of sawtimber valued at $79,941 and 1,015 cords of pulpwood valued at $3,551.

Applying the mortality estimates to the entire 3,004 acres of defoliation, yields an estimated total damage of $221,185. This figure includes 3.2 million board feet of sawtimber valued at $211,775 and 2,688 cords of pulpwood valued at $9,410. These dollar estimates represent the stumpage value of the timber at the time of death and should not be considered at its present or salvage value. Stumpage values used were $65 per MBF of sawtimber and $3.50 per cord of pulpwood.

Only 94 acres (8%) of the entire 1,134 acres cruised have sufficient dead volume per acre to be salvaged in a commercial timber sale. Mortality was greatest in the sawtimber stands (stands where more than 50% of the trees are over 11 inches diameter breast height) which comprised 53% (606 acres) of the area cruised. Here, 21% of the total basal area was lost to mortality. The damage in these stands was estimated to be $119.19 per acre. Oak species, which accounted for 78% of total sawtimber stand composition, exhibited the highest species mortality. Twenty-five percent of the total oak sawtimber basal area died after one heavy defoliation. Hickory was the next most vulnerable species to mortality, as 16% of the total hickory sawtimber basal area died. Miscellaneous species, predominantly yellow-poplar, black gum, virginia pine and white ash suffered no substantial mortality in the defoliated stands.

In addition to the stress resulting from gypsy moth defoliation and subsequent refoliation, tree mortality was influenced by the 1986 summer drought and attack from secondary organisms of which the two-lined chestnut borer was the most noticeable. By October 31, 1986, total rainfall since January 1 averaged 7.6 inches below normal in the eastern panhandle counties.

Additional timber mortality of at least 5-10% of stand basal area is expected during 1987 in all of the cruise areas. Significantly higher mortality will result if another drought occurs in the cruise areas next spring and summer. The additional mortality expected in the summer of 1987 should make commercial salvage sales feasible.

Editors note: Copies of a more complete report can be obtained by contacting the author.

FIVE-MINUTE WALK METHOD OF SAMPLING GYPSY MOTH EGG MASS DENSITIES

by

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This method of estimating gypsy moth egg mass densities was developed during 1982-1983 to provide a fast and accurate method for the State of New York to evaluate potential treatment areas in New York State's gypsy moth integrated pest management program (IPM) (Eggen and Abrahamson, 1983). This method has worked very well in New York and with many other private and state agencies that needed a fast and accurate method for estimating gypsy moth egg mass numbers. This article has two objectives: (1) to emphasize the original guidelines within which the method was developed, and (2) to provide advice on uses of this method in areas and under circumstances that were not evaluated when this method was originally developed. Therefore, extreme care must be taken when using this method outside the original constraints until it can be properly evaluated under these conditions. The following guidelines take both these objectives into consideration:

(1) Take two five-minute walks per area counting the new egg masses. Each walk should cover approximately 500 feet and the surveyor should <u>not</u> stop walking or walk in tight circles. The five-minute walk should be conducted in gypsy moth host type even if a change in direction is necessary. It is strongly suggested that if one person is surveying, one egg mass count should be taken in a predetermined direction, and the second egg mass count taken by turning around and using the same route back. If two people are surveying, each person should take an egg mass count going in the same direction. <u>Each five-minute count is the average of these two counts.</u>

(2) The size of the area for each egg mass count depends on what you are interested in. If you are surveying potential treatment blocks of similar tree species type, one average count may be enough. However, if the area is large (over 50-100 acres), or if there is a change in species type or elevation, then additional counts will be needed. The more counts you make the more accurate your estimate will be. This is especially important if you are near an action threshold egg mass count for the area you are surveying. Most of our treatment areas received at least two or more counts unless the area was <40 acres and very uniform in type and elevation.

(3) It is strongly suggested that the five-minute egg mass method be used in the fall of the year when it is easier to distinguish new from old egg masses.

(4) Since this method depends on new (current year's) egg mass counts, a new total egg mass ratio (percent of total egg masses that are new egg masses) may have to be determined if the survey crew has a difficult time distinguishing the difference between old and new egg masses. This is especially a problem when surveys are done in the spring instead of the fall of the year. From my experience with training survey crews, if there is any question concerning old vs. new egg masses, the old to new egg mass ratio should be determined and used. One hundred egg masses should be examined in each area to determine the new to total egg mass ratio (percent). Once a ratio has been determined, then during the five-minute walk all egg masses are counted (both old and new) and the five-minute walk egg mass (new) number is determined from the new to total egg mass ratio. [example: 70 egg masses out of 100 examined in an area were determined to be new (current year's egg mass) and 30 egg masses were old. A new total egg mass ratio is 70/100. This ratio times the five-minute walk count for the area will give you the corrected new egg mass count for the five-minute walk.]

(5) The use of hand-counters is highly recommended when doing the five-minute walk. <u>Each egg mass is counted separately</u>, do not count by bunches (10 here, 5 there, and looks like 20 over there). The hand counters are necessary, as it is very easy to forget what number you are on, especially if numbers are high, and they force you to count each egg mass separately.

(6) If the average of the two five-minute walk egg mass counts for an area exceeds 20 egg masses, em/A can be estimated using the method described in the manual, (Estimating Gypsy Moth Egg Mass Densities (Eggen and Abrahamson, 1983); equations and Tables 2-4). Any average below this number should not be used for estimating egg masses by this method, since these low egg mass counts were not validated in our study. (We originally stated that 40 egg masses was the cutoff level, but I feel that we can go as low as a count of 20 egg masses for the average of the two five-minute walk counts and still be accurate.) When the average of the two five-minute egg mass counts is less than 20 em, the variable and fixed radius plot method using a BAF-20 prism (or similar method) should be used to estimate em/A. A minimum of 3 prism plots per area should be used. Table 5 in our manual can be used with the BAF-20 prism plot method to determine the overstory portions of the total estimated em/A.

(7) Table 1 of our manual is included to help with survey estimates in those areas that experience a build up of the gypsy moth for the first time and was constructed from data provided by E. Eckess, USDA-APHIS, University Park, PA. This is the only table that can be used for average five-minute walk em counts of less than 20, in fact, it is most accurate for counts between 1 and 21. This table is <u>not</u> for areas that have experienced gypsy moth defoliation in the past; it is only for new low infestation.

(8) Table 2 is used when gypsy moth has been in the area before, some defoliation (<50%) has occurred the year before and it is very hard to find old egg masses. Egg masses are usually medium to large and healthy appearing.

(9) Table 3 is used when the area has received at least one year of heavy defoliation (>60%) and a second year of defoliation is expected. Egg mass densities are very high. There are still more new than old egg masses, but new egg masses may be smaller than the old egg masses. Most egg masses are medium size with a few large and small egg masses present. This table is used until the next table is clearly definable.

(10) Table 4 is used when the area has experienced two or more consecutive years of heavy defoliation (>60%), and there are more old than new egg masses in the area. The new egg masses are usually small. The outbreak could collapse this year or the following year.

(11) Use of this method in evaluating treated areas is not recommended without verifying the accuracy of the results. This method was not developed with data from treated plots and therefore we do not have confidence in the results without some verification. However, if this method is used, I would suggest that you use the table (or equation) based on size and number of egg masses in the treated plot compared to the surrounding area (control area). If the egg masses are the same size or the total new egg mass counts are similar as the surrounding area use the same table. If the egg mass size is larger than the surrounding area and/or the total new egg mass count is greatly reduced then use the table for the situation found earlier in the duration of the gypsy moth outbreak. [example: if surrounding area is defined as using Table 3 then Table 3 or Table 2 should be used depending on size of new egg masses and total number of new egg masses. If the surrounding area is defined as using Table 4 then Table 4 or Table 3 should be used depending on new egg mass size and number. Never back off more than 1 Table from what is being used in the surrounding area. If Table 2 is being used in the surrounding area, then use Table 2 in the treatment area, do not back off to Table 1 if Table 2 is being used in the surrounding area.]

(12) The five-minute walk method has been used successfully in many States and under many different situations. It is very important that we get some verification of the accuracy of this method under different conditions than when it was developed. I strongly encourage anyone who has verified this method under "different" conditions to provide me with your results so that we can update this popular method and provide accurate recommendations for increasing uses of this method.

Editors note: Copies of the 5 minute walk manual are available by writing the author. Ask for: Estimating Gypsy Moth Egg Mass Densities, 1983 by Eggen and Abrahamson, SUNY College of Environ. Sci. and Forestry, School of Forestry, Misc. Pub. No. 1, ESF 83-001.

DEVELOPMENT OF AN EXPERT SYSTEM PROTOTYPE FOR THE AERIAL APPLICATION OF INSECTICIDES FOR GYPSY MOTH SUPPRESSION

Michael Saunders, Entomologist
Penn State University

Daniel Twardus, Entomologist
USDA Forest Service
Forest Pest Management

The USDA Forest Service, Northeastern Forest Experiment Station, is sponsoring the development of the Expert System as part of its expanded Gypsy Moth Research and Development program. Here is a brief description of the project.

Aerial application of insecticides for gypsy moth suppression can be represented by a decision-making process requiring information about: gypsy moth population dynamics, gypsy moth impact to trees, tree values, pesticide effectiveness, pesticide use, pesticide safety, aircraft spraying systems, and insect sampling techniques. People who make decisions about aerial application, must assimilate various amounts of information from these subjects. They do this with varying degrees of success often frustrated by incomplete information, insufficient expertise to interpret information, or use of inappropriate information.

Since 1982, aerial application of insecticides for gypsy moth suppression occurred on over 3 million acres in the northeast, and required between 20 and 30 million dollars to implement. In recent years the use of insecticides (biological or otherwise), has come under close public scrutiny as people have become more aware of the environmental hazards resulting from pesticide misuse. These facts notwithstanding the aerial application of insecticides remains the principal management technique for gypsy moth outbreaks. Supporting the decision-making process involved in aerial application then, should be a high priority, in order to insure effective and efficient pesticide use. This project proposes to support that process through the development of an expert system prototype for the aerial application of insecticides for gypsy moth suppression.

'Expert' or knowledge based systems are relatively new computer programs designed to represent and apply factual knowledge of specific areas of expertise to help solve problems. This expert system would focus upon building a structure out of existing aerial application information, and aerial application decision-making processes.

Features of the proposed expert system include:

- The accumulation and codification of aerial application knowledge.

- The expert system will represent the best information available with regard to aerial application technology.

- The expert system will provide predictive modeling in the sense of providing answers for a given problem, and then showing how these answers would change for new situations.

- The expert system will represent a compilation of knowledge about aerial application technology as it relates to gypsy moth suppression. As such, it becomes a consensus of opinion and is a permanent record of the best strategies and methods to use. When key people leave, their expertise is retained. More importantly, their expertise is already part of an overall process.

There are at least 2 problems associated with attempting to build an expert system of this nature. The first, is the lack of a well defined knowledge base. Though this is a serious impediment to the development of an expert system, it is felt that since aerial application decisions are being made anyway, providing a structure to this process can only help, if incrementally.

The lack of consensus among experts as to the choice and accuracy of solutions in the problem solving process is another potential problem. This perceived lack of consensus will make extracting and validating knowledge very difficult. It is this same lack of consensus that frustrates users of information, and makes the attempted development of an expert system worthwhile.

Research Plan

1. Identification and conceptualization of aerial application problems. (March 15 - May 1, 1987)

   During this stage the important features of the problem will be identified, and the scope of the expert system will be fixed. This process was initiated by Daniel Twardus, (U.S. Forest Service), Ed Rajotte, Michael Saunders, Dennis Calvin, and Paul Flinn, (all Penn State University).

   A. In addition, a panel of experts has been identified whose expertise fits within components of the identified problem.

   B. A body of literature will also be identified for information that fits within components of the identified problem.

2. A knowledge base will be built consisting of information acquired from the panel of experts and from the literature. This will be done through direct interaction with the experts (May 1 - September 1, 1987).

3. Mapping of the knowledge base, including the formalizing of the basic concepts. This process involves fitting a structure to the overall knowledge base, and includes finding and validating rules within the knowledge base. At this stage, the knowledge assumes a more formal representation as suggested by the expert system tool, in this case Rulemaster[R]. Rulemaster, an expert system shell, is currently

available on the Pennsyulvania Extension network VAX 11/785 minicomputer. (September 1 - February 1988).

4. Concomitant with the development of the expert system will occur development of the Treatment Monitoring Data Base (TMDB). The TMDB, was initiated in 1985 by Daniel Twardus as a method of recording, compiling, and manipulating information from operational gypsy moth spray projects. In 1986, over 300 spray blocks were monitored in 6 States. In 1987, nearly 500 spray blocks have been monitored as part of this system.

Over 70 variables are included in the TMDB. The compilation of information from this data base, provides an empirical knowledge base of the expert system to draw upon. That is, for example, if the expert system requires informaiton about aircraft performance - the TMDB provides actual case histories of aircraft performance.

More information about either the expert system or the Treatment Monitoring Data Base can be obtained by contacting D. Twardus, USDA Forest Service, 180 Canfield Street, P.O. Box 4360, Morgantown, WV 26505, or Michael Saunders, Entomologist, Penn State University, Dept. of Entomology, 662 N. Cemetery Rd., North East, PA 16428.

FORECAST SAYS GYPSY MOTH COULD DEFOLIATE 2.2 MILLION ACRES IN 1987.

A perennial quandy for Forest Pest Management (FPM) administrators is: How much forest area will gypsy moth defoliate next season? FPM planning and budgeting can only be as good as the underlying estimates of the size of the problem.

Since 1983, researchers at the Northeastern Forest Experiment Station have been using a multiple time-series technique called state-space analysis to forecast gypsy moth defoliation acreage. The best results have been achieved by including time-series (annual information since 1936) for: 1) area defoliated, 2) acres of susceptible forest in the infested zone), 3) average annual temperature, and 4) average annual rainfall.

Comparisons between the forecast and actual defoliation acreages are:

	Forecast	Actual
	----Million Acres----	
1980	---	5.0
1981	---	12.9
1982	---	8.2
1983	2.4	2.4
1984	1.1	1.0
1985	1.6	1.7
1986	2.3	2.4
1987	2.2	?
1988	2.0	?
1989	1.7	?

The forecast results thus far have been beyond expectations--in a word, fantastic. Will this success continue? Only time will tell!

Additional information on the forecasting system is available from Dave Gansner, Northeastern Forest Experiment Station, USDA Forest Service, 370 Reed Road, Broomall, PA 19008.

MEETINGS

Coping with the Gypsy Moth in the New Frontier
West Virginia University
Morgantown, WV
August 4-6, 1987

As the gypsy moth moves south and westward into the commercial forests of the Appalachian uplands, the potential impact on forest resources is great. The goal of this workshop is to provide state-of-the-art information to forest resource managers in this "New Frontier" as they attempt to cope with the gypsy moth.

For information contact: Dr. Ray Hicks, c/o WVU Conference Office, Room 67, Towers, Morgantown, WV 26506.

Southern Forest Insect Work Conference
San Antonio, Texas
August 10-13, 1987

The 32nd Annual Southern Forest Insect Work Conference will meet at the Riverwalk Holiday Inn in downtown San Antonio, Texas, August 10-13, 1987. Reservations must be made by July 27 to assure the special flat rate of $61.00 per room.

For information contact: Jerry Lenhard, Department of Entomology, Louisiana State University, Baton Rouge, LA 70803, telephone 504-388-1634.

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